

Sub a1
1 1. A device for retaining a prosthesis in a body
2 passage comprising an annular, resilient element with an
3 undeformed diameter greater than the diameter of said body
4 passage.

1 2. The device of claim 1 wherein said annular
2 resilient element has a circular cross-section when
undeformed.

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1 3. The device of claim 1 *further* including a tubular graft
2 attached to said element.

1 4. The device of claim 1 wherein said element is
2 formed by wrapping a plurality of windings of wire around a
3 common core and connecting said windings together.

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1 5. The device of claim 1 wherein said wire is
2 formed of a superelastic phase nickel-titanium alloy.

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1 6. The device of claim 1 *further* including a pair of
2 elements, said elements connected by a tubular graft.

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1 7. The device of claim 1 *further* including a tubular
2 graft, said element being connected to one end of said
3 tubular graft, said tubular graft having a first diameter
4 proximate to said connection to said element and a second
5 diameter spaced away from said element, said first diameter
6 being greater than said second diameter.

1 8. The device of claim 7 wherein said graft is
2 formed from fabric.

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1 9. The device of claim 7 wherein said element is
2 connected to a fabric graft at only one end of said fabric
3 graft.

1 10. The device of claim 1 wherein said element is
2 situated inside a body passage in a C-shaped deformed
3 configuration, folded about a diametric axis of said
4 element.

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1 11. The device of claim 1, ^{further} including a bifurcated
2 graft connected to said element, said bifurcated graft
3 including a first tubular section connected to said element
4 and a pair of tubular sections connected to said first
5 tubular section, each of said pair of tubular sections
6 having free ends, and annular resilient deformable elements
7 connected to said free ends of said pair of tubular
8 sections.

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1 12. A prosthesis for insertion into a body passage
2 comprising an annular resilient spring element and a
3 flexible, tubular graft attached to said element, said
4 element having an undeformed diameter greater than the
5 diameter of said graft.

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1 13. The prosthesis of claim 12 wherein said ~~spring~~
2 element has a circular cross-section when undeformed, and
3 said element is formed by a plurality of circularly oriented
4 wire strands formed of a resilient metal, said graft having
5 a pair of opposed free ends, said spring element attached to
6 one of said free ends of said graft.

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14. The prosthesis of claim 12 wherein said graft has a pair of opposed free ends, said element connected to one of said free ends, the region of said graft proximate to said element having a diameter greater than the diameter of the portion of said graft spaced from that element.

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15. The prosthesis of claim 12 wherein said element is attached to one of two opposed free ends of said graft, said graft having a greater diameter on the end connected to said spring element than on said end spaced from said element, said graft tapering in diameter from said end connected to said element to a reduced diameter and having a relatively constant diameter over a portion of the remainder of the graft.

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16. The prosthesis of claim 12 wherein said graft is tubular and includes a pair of opposed free ends, ^{resilient} spring elements being attached to each of said free ends.

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17. The prosthesis of claim 12 wherein said graft is formed of fabric.

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18. The prosthesis of claim 12 wherein said graft includes a pair of opposed ends, ^{resilient} a spring element being attached to only one of said ends of said graft.

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19. The prosthesis of claim 12, ^{further} including a device for receiving a positioning wire.

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20. The prosthesis of claim 19 wherein said device includes an internal passage for releasably receiving said wire.

1 21. A vascular prosthesis for repairing a diseased
2 first vessel comprising:
3 a folded, resilient, annular ring having a
4 first pair of loops extending in one direction, and a second
5 pair of loops extending in the opposite direction, said
6 first and second pairs of loops connected together, and
7 a tubular graft connected to said ring, said
8 graft arranged to extend along the length of said first
9 vessel, said first pair of loops arranged to extend at least
10 partially past the point where a second vessel intersects
11 said first vessel, one of said second pair of loops defining
12 an opening to permit communication between said first and
13 second vessels, at least partially past said prosthesis.

1 22. The prosthesis of claim 21, said second pair of
2 loops are arranged to avoid occlusion of the renal arteries
3 when said prosthesis is positioned in the abdominal aorta.

1 23. The prosthesis of claim 21, wherein said
2 tubular graft has a diameter less than the undeformed
3 diameter of said annular ring.

1 24. The prosthesis of claim 21, wherein said
2 annular ring is formed by a plurality of strands of
3 resilient wire having a substantially common central axis.

1 25. The prosthesis of claim 24 wherein said ring is
2 circular in cross-section when undeformed.

1 26. The prosthesis of claim 21 wherein said tubular
2 graft has a pair of opposed free ends, annular rings being
3 connected to each of said free ends.

1 27. The prosthesis of claim 21 wherein said tubular
2 graft has a pair of free ends and an annular ring is
3 connected to only one of said free ends.

a 1 28. The prosthesis of claim 21, ^{further} including a device
2 for axially receiving a guide wire, said device adapted to
3 telescopically and releasably receive said guide wire.

Sub 25 1 29. An apparatus for securing a prosthesis to an
2 internal surface of a body passage comprising:
3 a resiliently deformable annular ring;
4 a tubular graft ² having a pair of opposed free
5 ends, one of said free ends attached to said annular ring;
6 and
7 a device adapted to enable said ring to be
8 remotely compressed and expanded.

a 1 ^{further} 30. The apparatus of claim 29 wherein said device
2 includes a guide wire catheter that extends axially through
3 said prosthesis, said guide wire catheter adapted to
4 releasably engage said annular ring when folded, on a
5 diametric axis, into a C-shape and each of the loops
6 extending outwardly from said axis so as to enable the
7 amount of deformation of said loops relative to one another
8 to be adjusted.

1 31. The apparatus of claim 30 wherein each of said
2 connections is releasable from a remote location.

Sub 26 1 32. A prosthesis for insertion within a body
2 passage comprising:
3 a first prosthesis section including a
4 resiliently deformable annular spring element and a tubular

5 graft, said tubular graft having a pair of free ends, said
6 annular spring element connected to one of said free ends;
7 and
8 a second prosthesis section arranged to engage
9 the interior of said first prosthesis section in common
10 axial alignment therewith, said second prosthesis section
11 including a resiliently deformable annular spring element
12 adapted to engage an internal surface of said tubular graft
13 of said first prosthesis section so as to adjust the
14 resulting length of the prosthesis.

1 33. The prosthesis of claim 32 wherein said second
2 prosthesis section includes a tubular graft attached to said
3 annular spring element, said tubular graft having a pair of
4 free ends, one of said free ends connected to said spring
5 element and the other of said free ends connected to a
6 device for retaining said free end in an open configuration.

1 34. The prosthesis of claim 33, wherein said device
2 includes a pair of relatively rigid elements defining a pair
3 of independent passages into said free end of said second
4 prosthesis section.

1 35. The prosthesis of claim 34 including third and
2 fourth prosthesis sections telescopically engaging said
3 relatively rigid elements on said free end of said second
4 prosthesis section, each said third and fourth prosthesis
5 sections including a pair of annular resilient deformable
6 spring elements and a tubular graft, said spring elements
7 attached to free ends of said tubular graft, at least one of
8 said spring elements adapted to engage the interior of said
9 second prosthesis section.

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1 36. The prosthesis of claim 35 wherein said second
2 prosthesis section includes a graft which has one end which
3 defines a single passage and an opposite end which defines a
4 pair of bifurcated passages which communicate with said
5 single passage.

1 37. A method for securing a prosthetic device in a
2 body passage comprising the steps of:

3 folding a resilient annular ring to assume a
4 first configuration having a cross-sectional area smaller
5 than the cross-sectional area of said undeformed ring;

6 positioning said ring at a desired position
7 within a body passage; and

8 allowing said ring to resiliently deform to a
9 second configuration having a larger cross-sectional area
10 than in said first configuration, but still having a cross-
11 sectional area smaller than that of said undeformed ring.

1 38. The method of claim 37 including the steps of
2 deforming said ring prior to inserting said ring in said
3 body passage, positioning said ring at a desired location in
4 a body passage and causing said ring to expand and engage
5 that body passage.

1 39. The method of claim 38 including the steps of
2 selectively compressing and releasing the compression of
3 said ring in position within a body passage using a remote
4 actuator.

1 40. The method of claim 37 including the steps of
2 inserting said prosthetic device into a desired location in
3 a body passage by inserting said prosthetic device into the
4 interior of a tubular catheter, positioning the catheter at
5 a desired location within a body passage and ejecting said
6 prosthetic device from the interior of said catheter.

1 41. A method for repairing a diseased vessel
2 comprising the steps of:
3 folding an annular ring around its diametric
4 axis to assume a smaller cross-sectional configuration;
5 forming a pair loops extending away from said
6 axis; and
7 arranging said ring in said vessel with said
8 diametric axis proximate to an intersecting vessel such that
9 said loops extend at least partially past the intersecting
10 vessel without occluding said intersecting vessel.

1 42. The method of claim 41 including the step of
2 causing said annular ring to be resiliently biased against
3 said diseased vessel when in place in the patient's body.

1 43. A method of securing a prosthetic device inside
2 a body passage comprising the steps of:
3 deforming an annular resilient spring by
4 folding said spring along its diametric axis;
5 positioning said spring inside a body passage
6 and causing said spring to expand resiliently against said
7 body passage; and
8 causing said spring to continuously press
9 outwardly against said body passage.

1 44. The method of claim 43 wherein said prosthetic
2 device includes a tubular graft connected to said spring,
3 said method further including the steps of inserting a
4 second prosthetic device telescopically within the interior
5 of said tubular graft and causing an annular resilient
6 spring member to extend outwardly to engage the interior
7 surface of said graft.

1 45. The method of claim 43 including the step of
2 adjusting the length of said prosthetic device by inserting
3 a second prosthetic device telescopically into said first
4 prosthetic device.

1 46. The method of claim 44 including the step of
2 telescopically inserting a pair of stents inside the second
3 prosthetic device to form a passage from the iliac arteries
4 to the abdominal aortic artery.

1 47. A prosthetic device comprising:
2 a prosthetic heart valve;
3 a flexible tubular ^{graft} sleeve having a first end
4 connectable to said valve and a second end; and
5 a deformable, resilient annular ring connected
6 to said second end and arranged to connect said graft to the
7 interior surface of a portion of the ascending aorta.

a 1 48. A prosthesis for insertion into a body passage
2 comprising at least two annular resilient ~~spring~~ elements
3 and a flexible tubular graft attached to each of said
4 elements and a rigid member longitudinally connecting said
5 elements, said member being less flexible than said graft.

1 49. . The prosthesis of claim 48 wherein said member
2 is a wire connecting said elements.

1 50. A method for inserting a prosthesis into a body
2 passage, comprising the steps of:
3 inserting a pair of tubular prostheses together
4 into a body passage; and
5 telescopically adjusting the position of one of
6 said prostheses within the other of said prostheses.

a 1 51. The method of claim 50 including the step of
2 collapsing an annular resilient ~~spring~~ element on each of
3 said prostheses prior to inserting them together into said
4 passage to secure said elements to said passage and to each
5 other.

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